

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)



(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 159987 S-AT	FOR FURTHER ACTION	
	See Form PCT/IPEA/416	
International application No. PCT/NO2004/000404	International filing date (day/month/year) 29.12.2004	Priority date (day/month/year) 30.12.2003

International Patent Classification (IPC) or national classification and IPC
INV. H04L12/24

Applicant
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1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. (*sent to the applicant and to the International Bureau*) a total of 3 sheets, as follows:
 - sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. (*sent to the International Bureau only*) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- Box No. I Basis of the report
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

Date of submission of the demand 31.10.2005	Date of completion of this report 11.04.2006
Name and mailing address of the international examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer Cichra, M Telephone No. +31 70 340-4098



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International application No.
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Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
 - This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
 - international search (under Rules 12.3 and 23.1(b))
 - publication of the international application (under Rule 12.4)
 - international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-28 as originally filed

Claims, Numbers

1-14 received on 10.11.2005 with letter of 10.11.2005

Drawings, Sheets

1/7-7/7 as originally filed

a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. The amendments have resulted in the cancellation of:
 - the description, pages
 - the claims, Nos.
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
 - any table(s) related to sequence listing (*specify*):
4. This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
 - the description, pages
 - the claims, Nos.
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
 - any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-15
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-15
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-15
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

**INTERNATIONAL PRELIMINARY
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(SEPARATE SHEET)**

International application No.

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1 Reference is made to the following document:

D1 : TUVA HASSEL STANG, FAHIMEH POURBAYAT, MARK BURGESS,
GEOFFREY CANRIGHT, SMUND WELTZIEN, AND KENTH ENGO:
"Archipelago: A Network Security Analysis Tool" PROCEEDINGS OF THE
17TH LARGE INSTALLATION SYSTEMS ADMINISTRATION CONFERENCE,
[Online] 26 October 2003 (2003-10-26), - 31 October 2003 (2003-10-31) pages
1-19, XP002328096 SAN DIEGO,CA Retrieved from the
Internet: URL:http://www.usenix.org/events/lisa03/tech/full_papers/stang/stang_html/; [retrieved on 2005-05-12]

1.1 Referring to **claim 1** Document D1 discloses:

A method for determining the ability of a network to spread information or physical traffic, said network including a number of network nodes interconnected by links, with the following steps:

- mapping the topology of a network,
- computing a value for link strength between the nodes,
- computing an Eigenvector Centrality index for all nodes, based on said link strength values,
- identifying nodes which are local maxima of the Eigenvector Centrality index as centre nodes,
- grouping the nodes into regions surrounding each identified centre node,
- assigning a role to each node from its position in a region, as centre nodes, region member nodes, border nodes, bridge nodes, dangler nodes,
- measuring the susceptibility of the network to spreading, based on the number of regions, their size, and how they are connected.

2 Statement concerning novelty

2.1 The subject matter of **claim 1** differs from the known method of D1 in that the role of region member nodes in a given region is assigned to all nodes for which the steepest ascent link path in the topology map terminates uniquely at the centre node of that region.

2.2 The subject matter of **claim 1** is therefore new (Art. 33 (2) PCT).

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3 Statement concerning inventive step

3.1 D1 is considered the closest prior art.

3.2 The problem to be solved by the invention can be seen in:

how to assign essentially every node of the network to some unique region, whereas the method of D1 places a considerable number of nodes in no region (in the border set), which has the disadvantage to produce inaccurate information about the spreading of information in the network.

3.3 The solution proposed for this problem by **claim 1** is inventive for the following reasons (Art. 33(3) PCT):

D1 does not suggest or hint at using the steepest ascent link path method for assigning the role of region member nodes to nodes in a given region of a network. The method used in D1 places a large number of nodes in the border set (s. D1, page 10, 550 out of 992 nodes).

3.4 The further documents cited in the international search report do not contain any further substance beyond D1. They are further away from the subject matter of the invention and none of them suggests or hints at the use of the steepest ascent link path method.

3.5 The subject matter of independent claim 1 is therefore based on an inventive step over D1 (Art. 33(2) PCT).

4 **Claims 2-14** are dependent on claim 1 and therefore also fulfill the requirements of novelty and inventive step (Art. 33(2) and Art. 33(3) PCT).

C l a i m s
(Amended 4.11.2005)

(59)

1. A method for determining the ability of a network to spread information or physical traffic, said network including a number of network nodes interconnected by links,
5 said method including the steps of
- mapping the topology of a network,
 - computing a value for link strength between the nodes,
 - 10 • computing an Eigenvector Centrality index for all nodes, based on said link strength values
 - identifying nodes which are local maxima of the Eigenvector Centrality index as centre nodes,
 - 15 • grouping the nodes into regions surrounding each identified centre node,
 - assigning a role to each node from its position in a region, as centre nodes, region member nodes, border nodes, bridge nodes, dangler nodes,
 - 20 • measuring the susceptibility of the network to spreading, based on the number of regions, their size, and how they are connected

c h a r a c t e r i z e d i n

- 25 • assigning the role of region member nodes in a given region to all nodes for which a steepest ascent link path in the topology map terminates uniquely at the centre node of that region.

2. A method as claimed in claim 1,
characterized in computing said link
strength value by counting the number of different types
of bonds any pair of nodes uses in their interaction, us-
5 using the number of bonds as a measure for link strength.
3. A method as claimed in claim 1,
characterized in computing said link
strength value by measuring the traffic between any two
nodes, using the measure of traffic as a measure for link
10 strength.
4. A method as claimed in claim 1,
characterized in computing said link
strength value by measuring the traffic between each pair
of nodes for each different type of bond, dividing the
15 amount of traffic in each type of bond with the total
traffic for that type of bond, using the sum of the re-
sulting fractions as a measure for link strength.
5. A method as claimed in any of the claims 1 - 4,
characterized in organizing said link
20 strength values into a matrix, the adjacency matrix, and
computing the Eigenvector Centrality index as the princi-
pal eigenvector of said adjacency matrix.
6. A method as claimed in claim 1,
characterized in assigning the role of
25 border nodes to all nodes that have no unique association
to any one centre node.
7. A method as claimed in claim 1,
characterized in assigning the role of
bridge nodes to all border nodes which lie on at least one
30 non-self-retracing link path connecting two centre nodes.
8. A method as claimed in claim 1,
characterized in assigning the role of

dangler nodes to all border nodes, and lie on no non-self-retracing link path connecting two centre nodes.

9. Use of the method as claimed in any of the claims 1-8
for preventing the spreading of virus or harmful information
5 in a network.

10. Use of the method as claimed in any of the claims 1-8
for improving the spreading of information in a network.

11. Use of the method as claimed in any of the claims 1-8
for planning the architecture of a network, in order to
10 improve robustness and/or security and/or communication
efficiency in said network.

12. Use of the method as claimed in any of the claims 1-8
for planning the architecture of a power network in order
to improve the robustness of said network.

15 13. Use of the method as claimed in any of the claims 1-8
for planning a distribution network for goods.

14. Use of the method as claimed in any of the claims 1-8
for planning a transport network.